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U1S S1990 S2006

(56) Documents Cited
GB 2249586 A GB 1149857 A GB 0269592 A
EP 0433247 A1

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INT CL[5] H02K 5/20 5/24

(54) A vehicular AC generator

(57) A vehicular AC generator comprises a magnetic rotor 14, an excitation coil 10, a stator 3, and end brackets 1, 2 retaining the stator core and supporting the rotor shaft 5. Plural axial inlet openings 1a, 2a are provided in end faces of the brackets, and for plural outlet openings 1b, 2b are provided at outer peripheral faces of the brackets, for circulating cooling air, and fans 11, 12 are attached to end faces of the rotor pole core or cores 8, 9 for drawing cooling air through the inlet openings in the brackets. The outer configuration shape of the plurality of inlet openings 1a is non-circular.

FIGURE 1

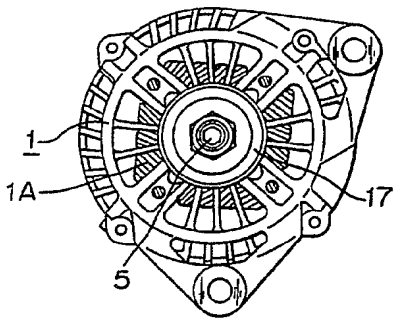

FIGURE 5

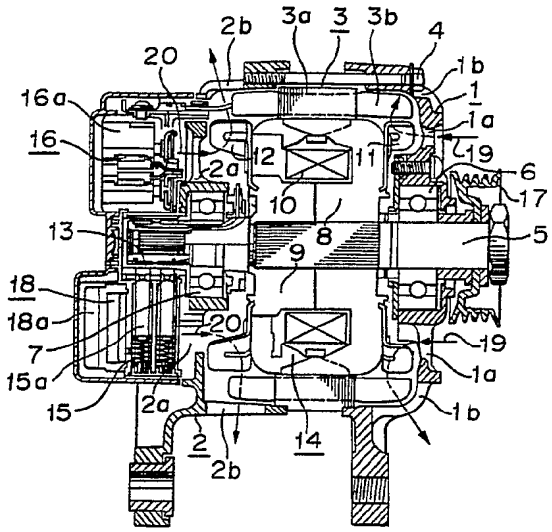

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FIGURE 1

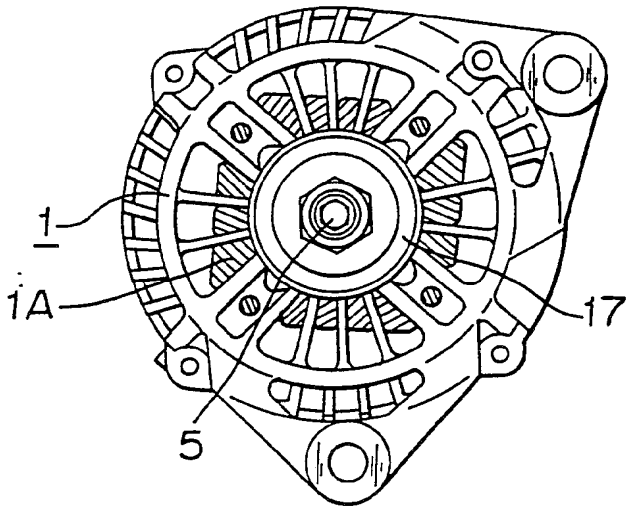


FIGURE 2

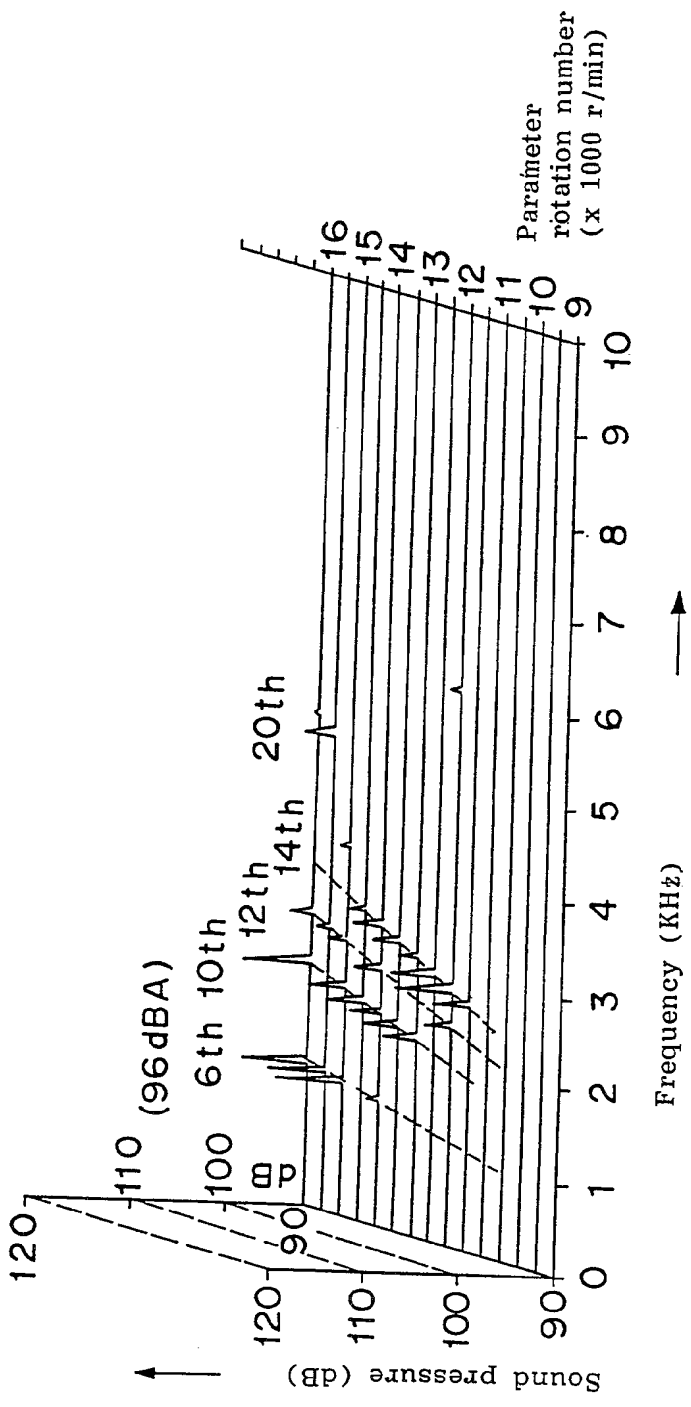

Sound pressure (dB)
120
110
100
90
dB
(96dBA)
6th
10th
12th
14th
20th
Frequency (KHz)
0 1 2 3 4 5 6 7 8 9 10
Parameter
rotation number
(x 1000 r/min)
9 10 11 12 13 14 15 16

FIGURE 3

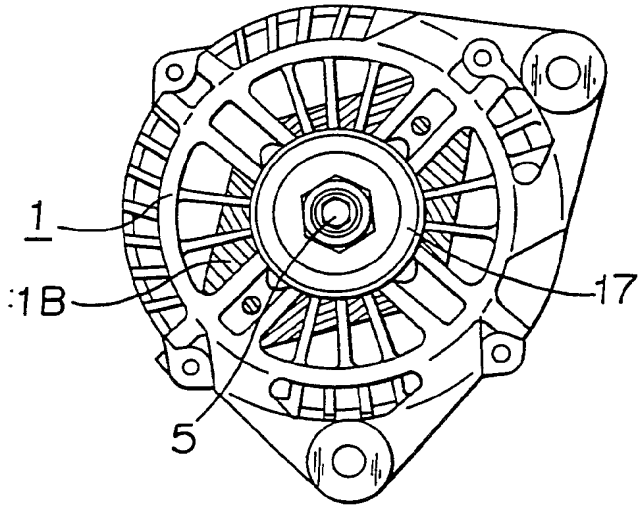


FIGURE 4

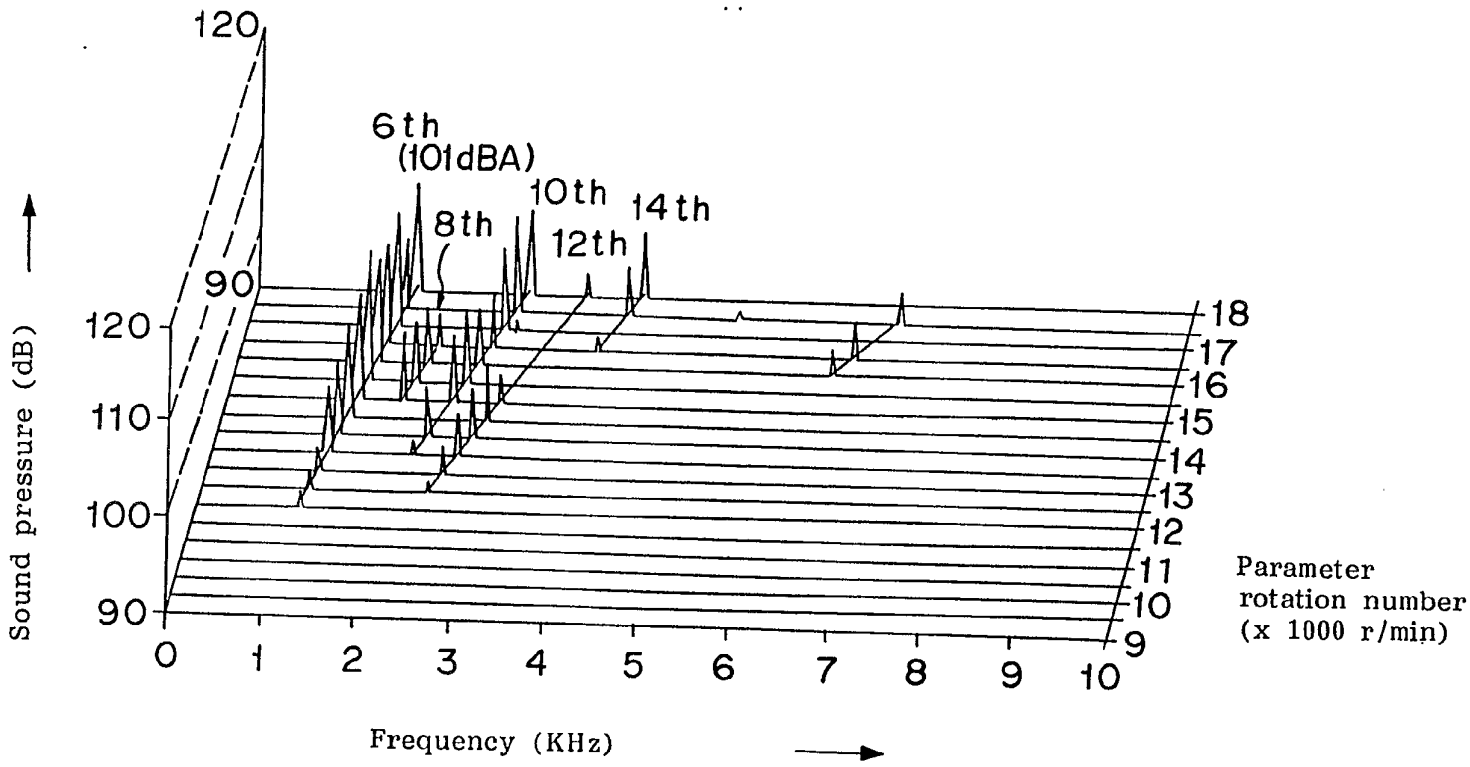

120
90
6th
(101dBA)
8th
10th
12th
14th
Sound pressure (dB)
120
110
100
90
0
1
2
3
4
5
6
7
8
9
10
Frequency (KHz)
18
17
16
15
14
13
12
11
10
9
Parameter
rotation number
(x 1000 r/min)

FIGURE 5

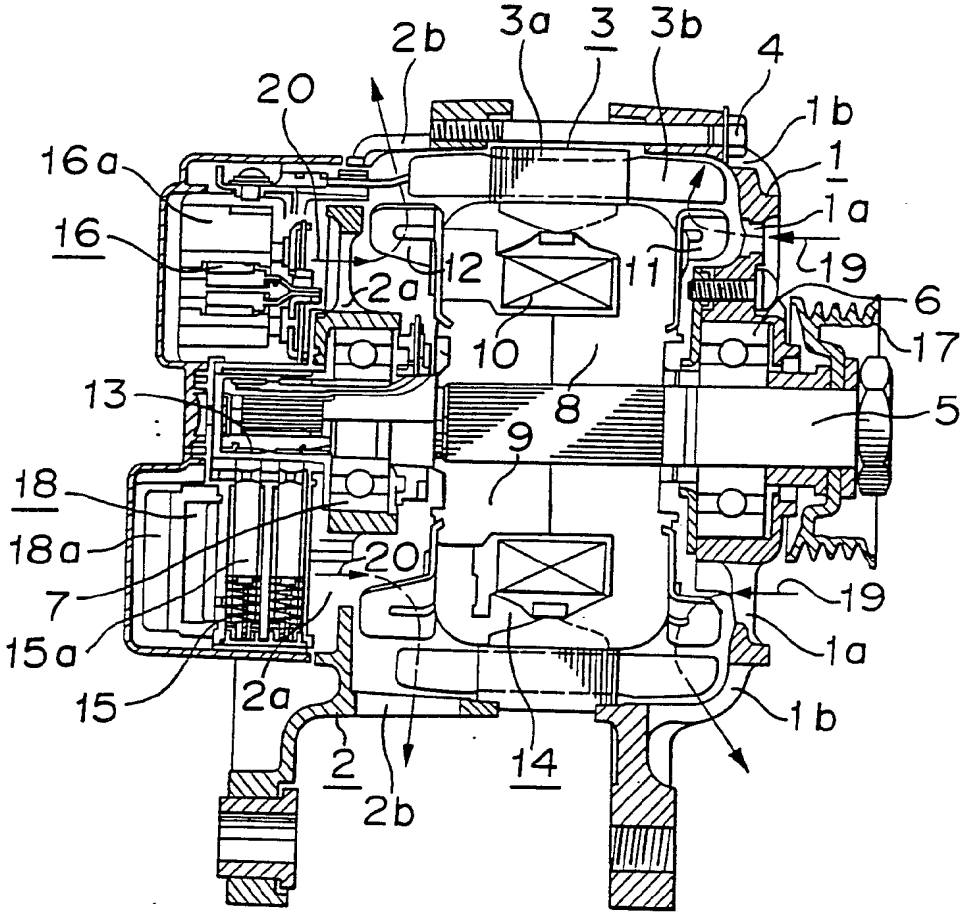

2b
3a
3
3b
4
20
1b
16a
1
1a
16
2a
12
11
19
6
17
10
13
8
5
9
18
18a
20
19
7
15a
1a
15
2a
1b
2
14
2b

FIGURE 6

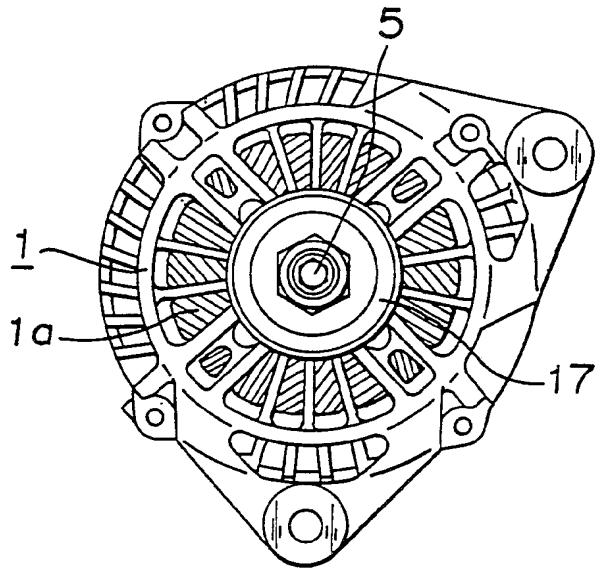


FIGURE 7

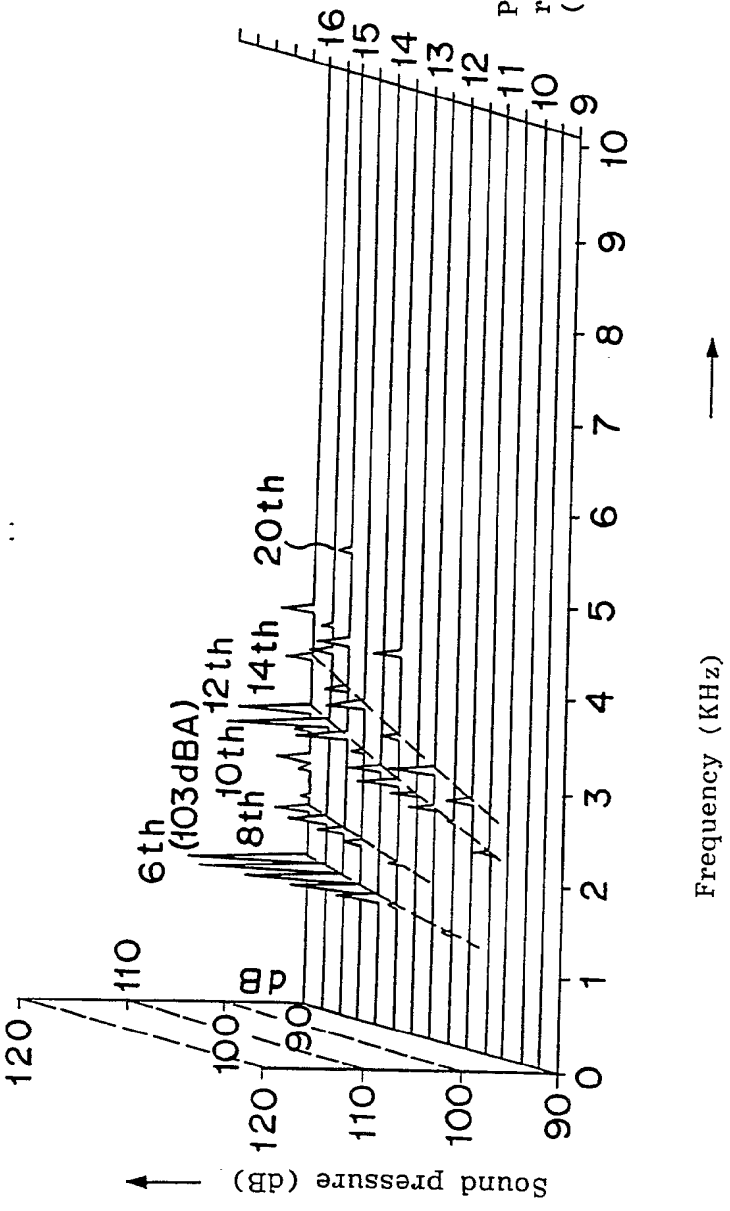
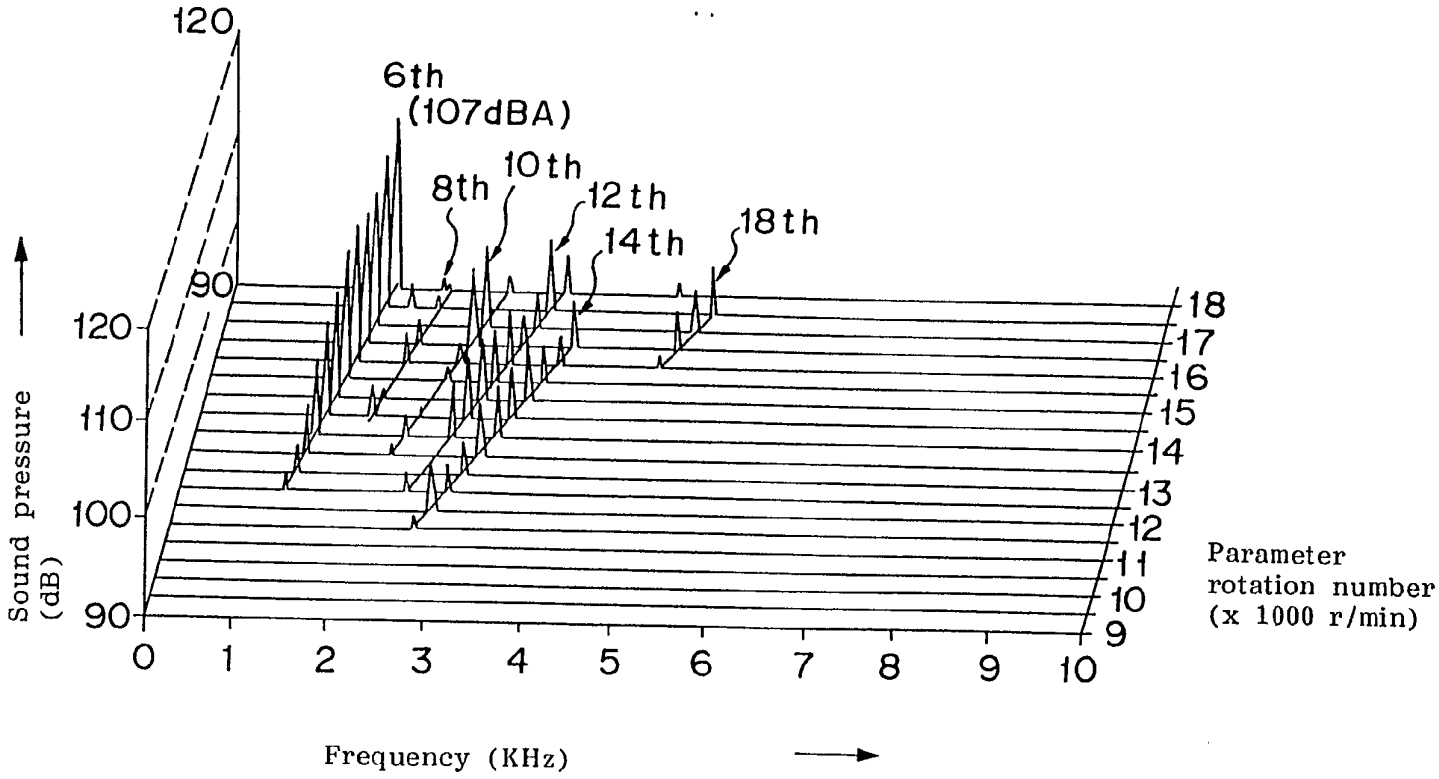

Sound pressure (dB)
120
110
100
90
dB
6th
(103dBA)
8th
10th
12th
14th
20th
Frequency (KHz)
0
1
2
3
4
5
6
7
8
9
10
Parameter
rotation number
(x 1000 r/min)
9
10
11
12
13
14
15
16

FIGURE 8


120
6th
(107dBA)
8th
10th
12th
14th
18th
90
120
110
100
90
Sound pressure
(dB)
0
1
2
3
4
5
6
7
8
9
10
Frequency (KHz)
18
17
16
15
14
13
12
11
10
9
Parameter
rotation number
(x 1000 r/min)

A VEHICULAR AC GENERATOR

The present invention relates to an alternating current generator which is used in an engine of a vehicle such as a motorcar.

Figure 5 is an axially sectional diagram showing a conventional three-phase vehicular AC generator which is shown, for instance, in Japanese Unexamined Patent Publication No. 7039/1991, and Figure 6 is a diagram viewing Figure 5 from the right hand side thereof.

In Figures 5 and 6, numeral 1 designates a front side bracket, numeral 2 designates a rear side bracket, and numeral 3 designates a stator which is composed of a stator core 3a and a stator coil 3b that is wound around the stator core 3a. Notations 1a and 2a designate pluralities of inlet openings respectively provided on end faces of the two brackets 1 and 2. A shape surrounding the plurality of inlet openings 1a or 2a (hereinafter, outer configuration shape) is circular (hatched portion in Figure 6). Notations 1b and 2b

designate pluralities of outlet openings respectively provided at outer peripheral portions of the two brackets 1 and 2. Numeral 4 designates a bolt which clamps the stator core 3a by fitting rims of openings of the two brackets 1 and 2 to outer peripheral end portions of the stator core 3a. Numeral 5 designates a shaft which is rotatably supported by the two brackets 1 and 2 through bearings 6 and 7 that are also supported by the two brackets 1 and 2. Numerals 8 and 9 designate magnetic pole cores which are fixed to the shaft 5 and which are disposed inside of the stator 3, and numeral 10 designates an excitation coil which is inserted into the inner peripheries of the magnetic pole cores 8 and 9. Numerals 11 and 12 designate a pair of fans which are fixed to the respective end faces of the magnetic pole cores 8 and 9 and which are rotated concurrently with the rotation of the shaft 5. Numeral 13 designates slip rings attached to the shaft 5, and numeral 14 designates a rotor which is composed of the shaft 5, the magnetic pole cores 8 and 9, the excitation coil 10, the fans 11 and 12, and the slip rings 13.

Numeral 15 designates an electric collector for feeding electricity which incorporates inside thereof brushes 15a which abrasively contact the slip rings 13. Numeral 16 designates a rectifier which converts an alternating current into a direct current by rectifying the alternating current that is induced in the stator

coil 3b by feeding an excitation current from the brushes 15a to the excitation coil 10 through the slip rings 13 and by rotating the excitation coil 10 and the magnetic pole cores 8 and 9 by an engine (not shown) through a pulley 17. Notation 16a designates a heat sink for radiating heat that is generated at the rectifier 16. Numeral 18 designates a voltage regulator which regulates a terminal voltage by detecting a generator voltage and by controlling the excitation current, and notation 18a designates a heat sink for the voltage regulator 18.

Next, an explanation will be given of the operation of the conventional alternating current generator. Cooling air flows in the generator from the plurality of inlet openings 1a of the front side bracket 1 as shown by an arrow mark 19 by rotating the fan 11, cools the bearing 6, the magnetic pole core 8, the excitation coil 10, the stator core 3a and the stator coil 3b, and is exhausted from the plurality of outlet openings 1b to the outside. Similarly, cooling air flows in the generator from the plurality of inlet openings 2a of the rear side bracket 2 as shown by an arrow mark 20 by rotating the fan 12, cools the bearing 7, the voltage regulator 18, the rectifier 16, the magnetic pole core 9, the excitation coil 10, the stator core 3a and the stator coil 3b, and is exhausted to the outside from the plurality of outlet openings 2b.

In the conventional vehicular AC generator, the outer

configuration shape of the plurality of the inlet openings 1a is circular as shown in Figure 6. Therefore, the order dispersion effect of a wind sound is not sufficient.

The order dispersion effect signifies that a high noise level in a comparatively narrow frequency range of a noise is converted and dispersed into that in a wider frequency range and a total noise level of a noise which is synthesized by respective frequency components, is lowered.

Therefore, sonic pressures of specified order components, for instance, 6-th order component, 12-th order component and the like are enhanced as shown in Figure 7, thereby generating an unpleasant sound.

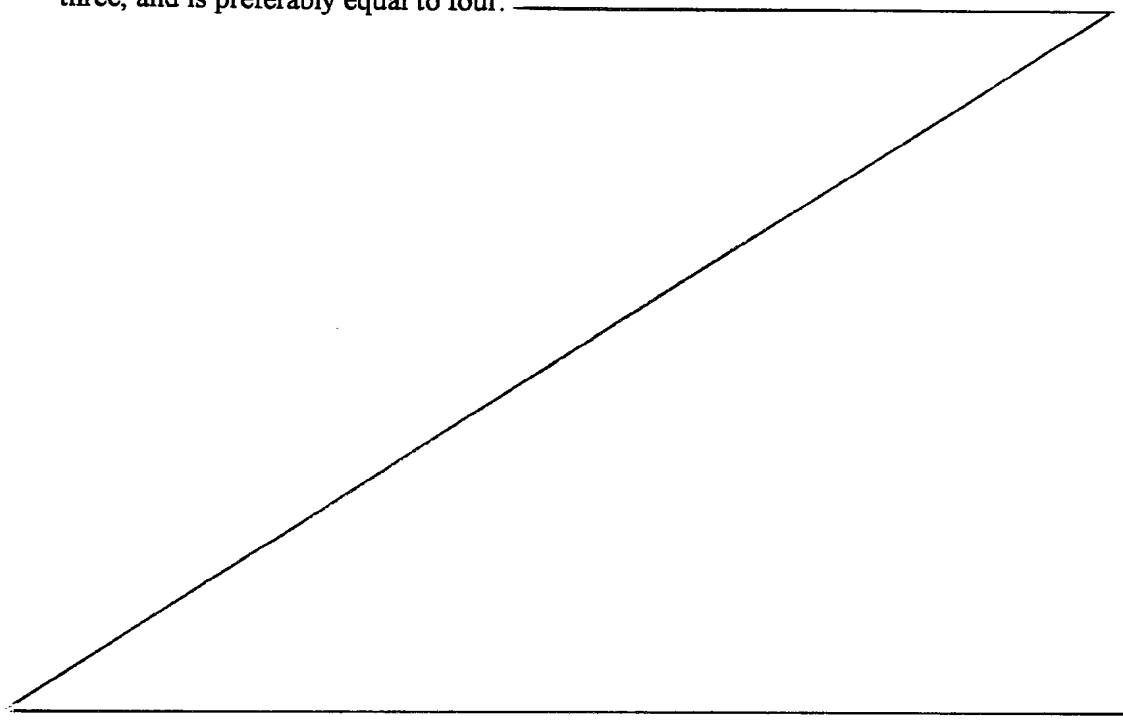
Further, in another conventional generator, the order dispersion effect of a wind sound is not sufficient since the outer configuration shape of the plurality of inlet openings is circular. As shown in Figure 8, the sonic pressures of the 6-th order component, 12-th order component and the like are similarly enhanced and an unpleasant sound is generated.

It is an object of the present invention to resolve the above problems and to provide a vehicular AC generator which achieves the dispersion of the order components of a wind sound, reduces the wind sound and accordingly diminishes the unpleasant sound.

This is achieved by providing that the envelope bounding the plurality of inlet openings is non-circular.

According to one aspect of the present invention, there is provided a vehicular AC generator comprising: a rotor with a rotor shaft and excited by an excitation coil; a stator core surrounding the rotor; end brackets retaining the stator core and supporting the rotor; a plurality of inlet openings provided in an end face of at least one bracket in the axial direction of the bracket for intake of cooling air; a plurality of outlet openings provided in an outer peripheral face of the said at least one bracket for egress of cooling air; and at least one fan attached to an end face of the rotor or cores for drawing cooling air through the inlet openings; wherein the outer configuration shape of the said plurality of inlet openings is non-circular.

In a preferred arrangement the generator is a three-phase AC generator and the non-circular envelope is a polygon of which the number of angles is not a multiple of three, and is preferably equal to four.



According to another aspect of the present invention, there is provided a vehicular AC generator comprising:

a magnetic pole core or cores fixed to a shaft and excited by an excitation coil;

a stator core surrounding the magnetic pole core and attached with a stator coil;

brackets retaining the stator core and supporting the shaft;

pluralities of inlet openings provided at end faces of the brackets in the axial direction of the brackets for circulating cooling air;

pluralities of outlet openings provided at outer peripheral faces of the brackets for circulating cooling air; and

fans attached to end faces of the magnetic pole core or cores for introducing cooling air from the pluralities of inlet openings into the brackets;

wherein an outer configuration shape of the pluralities of inlet openings is non-circular.

According to the present invention, the dispersion of the order components of a wind sound is achieved and the wind sound is reduced since the outer configuration shape of the pluralities of inlet openings is non-circular.

In the drawings:

Figure 1 is a diagram viewing from an end face of a bracket and showing Example 1 of this invention;

Figure 2 is an analytical diagram of wind sound frequencies in Example 1 of this invention;

Figure 3 is a diagram viewing from an end face of a bracket and showing Example 3 of this invention;

Figure 4 is an analytical diagram of wind sound frequencies in Example 3 of this invention;

Figure 5 is an axially sectional diagram showing a conventional example;

Figure 6 is a diagram viewing Figure 5 from the right hand side thereof;

Figure 7 is an analytical diagram of wind sound frequencies in the conventional Example; and

Figure 8 is an analytical diagram of wind sound frequencies in another conventional Example.

EXAMPLE 1

An explanation will be given of an example in reference to Figures 1 and 2. Figure 1 is a diagram viewing from an end face of a bracket, and Figure 2 is an analytical diagram of wind sound frequencies. A portion which is the same with or corresponding to one in the aforementioned conventional example, is attached with the same notation and the explanation will be omitted. In Figure 1, notation 1A designates a plurality of inlet openings which are provided at an end face of the front side bracket 1. As shown in Figure 1, the outer configuration shape of the plurality of inlet openings at the end face of the bracket (an outer configuration of

the hatched portion in the drawing) is a quadrangle. Further, the pole number of the alternating current generator is 12, the number of vanes of the front side fan is 10, and the number of vanes of the rear side fan is 14.

In this way, when the outer configuration shape of the plurality of inlet openings 1a is made quadrangular, in comparison with the data shown in Figure 7 for the plurality of inlet openings 1a having a circular outer configuration shape, the dispersion of the order components of a wind sound is achieved as shown in Figure 2, and therefore, the wind sound is diminished.

Further, the above explanation has been given to the plurality of inlet openings 1a of the front side bracket 1. However, a similar effect can naturally be provided with respect to the plurality of inlet openings 2a of the rear side bracket 2.

EXAMPLE 2

In the above Example 1, the outer configuration of the plurality of the inlet openings 1a is quadrangular. However, a similar effect can be achieved when the outer configuration shape is a polygon, the number of angles of which excludes a multiple of 3, such as a pentagon, a heptagon, or an octagon. A polygon having the number of angles which is equal to a multiple of 3 such as a triangle is avoided to prevent the order components such as 6-th component, 9-th component, 12-th component or the

like from being superposed and enhanced.

EXAMPLE 3

In this Example, a plurality of inlet openings 1B are provided with a rhombic outer configuration shape. Figure 3 is a diagram viewing from an end face of a bracket, and Figure 4 is an analytical diagram of wind sound frequency. When the outer configuration shape of the plurality of inlet openings 1b is a rhombus as shown in Figure 3, in comparison with the data shown in Figure 8, the order components such as 6-th component, 12-th component and the like are diminished as shown in Figure 4, and the sound pressure level of a total of components is lowered. Further, in this Example as in Example 1, the pole number is 12, the number of vanes of the front side one is 10, and the number of vanes of the rear side fan is 14.

As stated above, according to the present invention, the dispersion of the order components of a wind sound is achieved and the reduction of the wind sound and accordingly the reduction of an unpleasant sound is achieved by making the outer configuration of the plurality of inlet openings a non-circular shape.

CLAIMS:

1. A vehicular AC generator comprising:

a rotor with a rotor shaft and excited by an excitation coil;

a stator core surrounding the rotor;

end brackets retaining the stator core and supporting the rotor;

a plurality of inlet openings provided in an end face of at least one bracket in the axial direction of the bracket for intake of cooling air;

a plurality of outlet openings provided in an outer peripheral face of the said at least one bracket for egress of cooling air; and

at least one fan attached to an end face of the rotor or cores for drawing cooling air through the inlet openings;

wherein the outer configuration shape of the said plurality of inlet openings is non-circular.

2. A vehicular AC generator comprising:

a magnetic pole core or cores fixed to a shaft and excited by an excitation coil;

a stator core surrounding the magnetic pole core and attached with a stator coil;

brackets retaining the stator core and supporting the shaft;

pluralities of inlet openings provided at end faces of the brackets in the axial direction of the brackets for circulating cooling air;

pluralities of outlet openings provided at outer peripheral faces of the brackets for circulating cooling air; and

fans attached to end faces of the magnetic pole core or cores for introducing cooling air from the pluralities of inlet openings into the brackets;

wherein an outer configuration shape of the pluralities of inlet openings is non-circular.

3. The vehicular AC generator according to Claim 2, wherein the vehicular AC generator is a three-phase alternating current generator and the outer configuration shape of the pluralities of inlet openings is polygonal wherein the number of angles of the outer configuration shape is not a multiple of three.

4. The vehicular AC generator according to Claim 3, wherein the outer configuration shape of the plurality of inlet openings is quadrangular.

5. A vehicular AC generator substantially as herein described with reference to figures 1 and 2 or figures 3 and 4 of the accompanying drawings.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report) -12-	Application number GB 9410148.2
Relevant Technical Fields (i) UK Cl (Ed.M) H2A (AKB3, AKJ2, AKC7) (ii) Int Cl (Ed.5) H02K 05/20, 05/24	Search Examiner J COCKITT Date of completion of Search 29 JULY 1994
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii)	Documents considered relevant following a search in respect of Claims :- 1-5

Categories of documents

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E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
A, Y	GB 2249586 A	(MISUBISHI)	1, 2 at least
Y	GB 1149857 A	(LUCAS) see rectangular air vents Figure 4	1, 2 at least
Y	GB 0269592 A	(ATELIERS) see air vents G	1, 2, 3 at least
Y	EP 0433247 A1	(OEMER) see column 12 lines 27-31 and Figure 2	1, 2 at least

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